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Original Research

# Conventional wound management versus a closed suction irrigation method for infected laparotomy wound – A comparative study

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ABSTRACT

*Objective:* The aim of this study was to evaluate the efficacy of a closed suction irrigation method for the management of infected laparotomy wounds.
*Methods:* This is a retrospective study on consecutive patients with infected laparotomy wounds managed in a single tertiary referral hospital from January 2004 to March 2009. The wounds were laid open, debrided and cleansed with hydrogen peroxide, povidone iodine and normal saline. The wounds were either conventionally treated with normal saline dressings followed by secondary suturing when healthy granulation tissues were formed (the Control group) or by the closed suction irrigation method after suturing the wound (the Study Group).
*Results:* There were 70 patients in the Study Group and 60 patients in the Control Group. The hospital stay (mean ± SD, 9.2 ± 0.1 vs. 20.5 ± 0.6 days, $P < 0.001$) and time to wound healing (mean ± SD, 8.1 ± 0.1 vs. 18.5 ± 0.6 days, $P < 0.001$) were significantly better in the Study Group than in the Control Group. The re-infection rate was also significantly lower in the Study Group (7.1% vs. 21.7%, $P < 0.05$).
*Conclusions:* Encouraging results were obtained with the use of the closed suction irrigation method for infected laparotomy wounds. The closed suction irrigation method decreased hospital stay and allowed early rehabilitation. The findings of our study need to be substantiated in large-scale randomized controlled trials.


## 1. Introduction

Postoperative wound infection is common and it causes significant morbidity and occasional mortality, prolongs hospital stay, and increases hospital costs.[1,2] Apart from wound infection prophylaxis, it is also important to have an effective method to manage postoperative wound infection.

Conventionally, infected laparotomy wound is managed by laying the open wound, debridement of necrotic tissues, and change of dressings until healthy granulation tissues are formed. The wound is then secondarily sutured. We have adopted a technique of closed suction irrigation method. This method subjects the subcutaneous layer of the wound to saline irrigation and subatmospheric pressure, thus removing any exudates and irrigant that may accumulate in the wound. Additionally, the closed suction irrigation method expedites wound healing by gradually obliterating the dead space, thus decreases wound re-infection rate, promotes angiogenesis and decreases tissue edema.

This study is a retrospective comparative study on the use of the closed suction irrigation method on patients with infected laparotomy wounds.

## 2. Patients and methods

This retrospective study included all patients with post-laparotomy wound infection managed in a single tertiary referral hospital from January 2004 to March 2009. The wounds were managed by a team of 4 general surgeons with the closed suction irrigation method (the Study Group). During this study period, there was another team of 4 general surgeons who managed the wounds with the conventional method (the Control Group). Systemic antibiotics effective against aerobes and anaerobes were given to all patients in the Study Group and the Control Group to control cellulitis around the infected wounds.

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**Fig. 1.** Infected laparotomy wound after laying open and debridement.

**Fig. 2.** Wound sutured with a subcutaneous drain for closed suction irrigation.

### 2.1. Conventional method (the Control Group)

The skin sutures of the infected wound were taken off and necrotic tissues were debrided. The wound was then irrigated with 3% Hydrogen Peroxide, 0.5% povidone iodine and then with 1 L of normal saline. Saline dressings were applied to the wound and the dressings were changed 2 times every day in the first 3 days and then daily every day thereafter (Fig. 1). Secondary suturing of the wound was carried out when healthy granulation tissues were formed.

### 2.2. Closed suction irrigation method (the Study Group)

The skin sutures of the infected wound were taken off and necrotic tissues were debrided. The wound was then irrigated with 3% Hydrogen Peroxide, 0.5% providone iodine and then with 1 L of normal saline. The skin and the fascia were then sutured separately. A Fr 12–16 sized tube with 5 mm side ports at 1–2 cm apart was embedded into the subcutaneous cavity. The two ends of the tube were brought out through two separate stab wounds made adjacent to the main wound. The subcutaneous cavity of the wound was irrigated with normal saline at a rate of 50 microdrops per minute by connecting one end of the tube to a bag of saline. The other end of the tube was connected to an adjustable vacuum pump with a container to collect the irrigant and the wound exudate. A continuous negative suction force of 100–150 mmHg was applied. This technique converted an open wound into a controlled and temporarily closed environment. The skin dressings were changed only when necessary (Figs. 2 and 3). Saline irrigation was stopped after 3 days and the tube was then removed.

### 2.3. Statistical analysis

The prospectively collected data were analyzed retrospectively. Continuous variables were expressed as mean ± standard deviation (SD) or median (range), and they were compared using the Mann–Whitney $U$ test. Categorical variables were compared by the $\chi^2$ test or the Fisher's exact test. $P$-value of $<0.05$ was considered as statistically significant.

## 3. Results

During the study period, there were 70 patients who were treated in the Study Group and 60 patients who were treated in the Control Group. The patients' characteristics are shown in Table 1. The total hospital stay (mean ± SD, 9.2 ± 0.1 vs. 20.5 ± 0.6 days, $P < 0.001$) and the time to wound healing (mean ± SD, 8.1 ± 0.1 vs. 18.5 ± 0.6 days, $P < 0.001$) were significantly better in the Study Group than the Control Group. The wound re-infection rate, which was defined as discharge from the wound with a positive culture after the wounds were sutured, was also significantly lower in the Study Group (7.1% vs. 21.7%, $P < 0.05$) (Table 2). The results of the bacterial cultures taken from the infected wounds are shown in Table 3.

**Fig. 3.** Wound healed satisfactory. Drain already removed. Skin stitches were ready to be taken off.

## 4. Discussion

Vacuum assisted closure (VAC) is a well-described technology with applications in a variety of "difficult to manage" acute and chronic wounds. It is known by many other names: TNP (topical negative pressure), SAP (sub-atmospheric pressure), VST (vacuum sealing technique) and SSS (sealed surface wound suction).[3] It involves the application of open cell foam to a wound, adding a seal of adhesive drape followed by the application of sub-atmospheric pressure to the wound in a controlled way. VAC provides a safe system with controlled programmable application with a measured magnitude of vacuum with a fail-safe alarm. Encouraging results on the rates of wound healing have been reported in the medical literature. There have been a small number of randomized controlled trials to substantiate these findings.[4–7] Our closed suction irrigation method is a modification of the VAC technique and it was applied to manage infected laparotomy wounds. In contrary to the VAC technique, there was no need to use a special foam dressing.

Localised soft tissue edema compresses the vascular and lymphatic systems in a wound. The closed suction irrigation method removes any excessive fluid and, therefore, it has been proposed to restore more normal vascular and lymphatic flow.[3] The conventional method of management of infected wound involves labour-intensive and potentially hazardous dressing changes. The closed suction irrigation method ensures a closed environment for the wounds. The closed suction irrigation method may mechanically triggered immunomodulation, neovascularization, and/or angiogenesis, thus leading to improved wound healing.

From our experience, the closed suction irrigation method is a promising technique. The closed suction irrigation method offers considerable advantages. It decreased the need for a lengthened hospitalization and allowed for earlier rehabilitation. Further studies and properly conducted randomized controlled trials are necessary to define the true role that this closed suction irrigation method can play in the management of postoperative infected wounds.

**Table 1**
Patient data.

| | Study group | Control group | *P*-value |
|---|---|---|---|
| Age, years (mean ± SD) | 47.7 ± 16.1 | 45.1 ± 15.7 | 0.363 |
| Male/Female, *n* | 51/19 | 42/18 | 0.719 |
| Body mass index (BMI), (mean ± SD) | 20.6 ± 2.4 | 20.6 ± 2.7 | 0.965 |
| Diabetes mellitus, *n* | 3 | 3 | 0.847 |
| Smoking, *n* | 23 | 18 | 0.727 |
| Albumin, g/l (median) | 30.5 | 30.4 | 0.767 |
| Pathology, *n* | | | |
| Acute cholecystitis | 27 | 29 | 0.262 |
| Perforated acute appendicitis | 18 | 17 | 0.737 |
| Acute intestinal obstruction with bowel resection | 19 | 11 | 0.235 |
| Perforated peptic ulcer | 6 | 3 | 0.650 |
| Interval between operation and wound infection, days (mean ± SD) | 3.7 ± 0.1 | 3.4 ± 0.1 | 0.249 |

**Table 2**
Clinical outcomes.

| | Study group | Control group | *P*-value |
|---|---|---|---|
| Time to complete wound healing, days (mean ± SD) | 8.1 ± 0.1 | 18.5 ± 0.6 | <0.001 |
| Hospital stay, days (mean ± SD) | 9.2 ± 0.1 | 20.5 ± 0.6 | <0.001 |
| Re-infection, *n* | 5 (7.1%) | 13 (21.7%) | 0.03 |

**Table 3**
Bacterial culture from infected wounds taken at the time of diagnosis.

| | Study Group | Control Group | *P*-value |
|---|---|---|---|
| Number and % of patients with positive culture | 58 (82.9%) | 51 (85.0%) | 0.741 |
| *Bacterial culture positive for: | | | |
| *Escherichia coli*, *n* | 31 | 27 | 0.363 |
| *Streptococcus faecalis*, *n* | 8 | 4 | 0.350 |
| Enterococcus species, *n* | 11 | 8 | 0.702 |
| Proteus species, *n* | 5 | 7 | 0.374 |
| *Pseudomonas aerogenosa*, *n* | 15 | 12 | 0.841 |
| Other aerobes, *n* | 6 | 4 | 0.939 |
| *Bacteroides fragilis*, *n* | 7 | 5 | 0.981 |
| Other anaerobes, *n* | 20 | 24 | 0.170 |

*One wound culture could yield more than one organisms.

*Ethical approval*
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None declared.

*Conflicts of interest*
None declared.

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